

Deep Learning for Safe Autonomous Driving: Current Challenges and Future Directions

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Abstract

Advances in information and signal processing technologies have a significant impact on autonomous driving (AD), improving driving safety while minimizing the efforts of human drivers with the help of advanced artificial intelligence (AI) techniques. Recently, deep learning (DL) approaches have solved several real-world problems of complex nature. However, their strengths in terms of control processes for AD have not been deeply investigated and highlighted yet. This survey highlights the power of DL architectures in terms of reliability and efficient real-time performance and overviews state-of-the-art strategies for safe AD, with their major achievements and limitations. Furthermore, it covers major embodiments of DL along the AD pipeline including measurement, analysis, and execution, with a focus on road, lane, vehicle, pedestrian, drowsiness detection, collision avoidance, and traffic sign detection through sensing and vision-based DL methods. In addition, we discuss on the performance of several reviewed methods by using different evaluation metrics, with critics on their pros and cons. Finally, this survey highlights the current issues of safe DL-based AD with a prospect of recommendations for future research, rounding up a reference material for newcomers and researchers willing to join this vibrant area of Intelligent Transportation Systems.